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EDITOR'S CORNER

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I'm pleased to share with you news that NASA was nominated for and has won three of *Popular Science* magazine's "Best of What's New" awards for 2002. The Gravity Recovery and Climate Experiment (GRACE), the Aqua mission, and the Mars Odyssey mission were chosen in the Aviation/Space category of the magazine's annual awards program. The December 2002 issue of *Popular Science* features 100 winners in 10 categories. The winners are considered the best among thousands of new and innovative products and services reviewed annually by the magazine, and represent significant advancements in their categories.

Of the three NASA missions, two are within the Earth Science Enterprise (ESE). GRACE is nine months into its mission to precisely measure the Earth's shifting water masses and map their effects on the Earth's gravity field. A global gravity field map created from just 14 days of GRACE data is proving to be substantially more accurate than the combined results of more than three decades of satellite and surface measurements collected before GRACE (see map on next page). These new gravity maps provide unprecedented insight into variations in the weight of the Earth's oceans and polar ice sheets, which will greatly advance studies of ocean circulation and ice sheet mass. GRACE is a joint partnership between NASA and the German Aerospace Center. The University of Texas Center for Space Research has overall mission responsibility, and the Jet Propulsion Laboratory manages the U.S. portion of the project for NASA.

Aqua is the latest in a series of larger EOS spacecraft dedicated to advancing our understanding of climate and global change. As its name implies, Aqua's instruments are primarily designed to gather information on the Earth's water cycle. Aqua is enabling greatly improved understanding of the global water cycle and its influence on the Earth's climate system. All of Aqua's six

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Summary of the International Workshop on Surface Albedo Product Validation

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Introduction and Overview

Boston University hosted the Committee on Earth Observation Satellites/Working Group on Calibration and Validation (CEOS/WGCV) Land Product Validation (LPV) Workshop on Surface Albedo October 23-24, 2002. The international workshop was held in association with the Moderate Resolution Imaging Spectroradiometer (MODIS) Radiation Products Outreach Workshop, and marked the fourth LPV topical workshop (following assemblies on Leaf Area Index, Fire/Burn Scar, and Land Cover). About 25 experts in satellite-product development, field measurements, and process modeling participated.

With Aqua and ENVISAT joining Terra in space this year, the volume of operational land products has become immense by traditional standards. Each new product has unique characteristics, the performance and accuracy of which can only be determined through postlaunch data analysis. To allow credible and responsible product use, these characteristics must be determined and described to the user community as quickly as possible. The

LPV Subgroup of the CEOS/WGCV helps coordinate researchers and activities to achieve these goals more effectively and economically.

MODIS Albedo Product Accuracy

The albedo workshop included both plenary presentations and breakout group discussions. **Crystal Schaaf** and **Yves Govaerts** briefed participants on the MODIS and METEOSAT albedo products, respectively, and their evaluation activities to date. Other researchers described their approaches to measuring plot-level albedo and comparing field-derived and airborne data to the MODIS product.

Collectively, the researchers found that the mean accuracy of the MODIS broadband (visible, near-infrared and shortwave) products is about 0.02 (absolute) over vegetated areas. A backup algorithm ("Magnitude Inversion"), used when an insufficient number of independent cloud-free samples are available in a 16-day compilation window, produces consistent results relative to the main algorithm. The current broadband product appears to

be systematically underestimating completely snow-covered areas, although it appears to handle mixtures of canopy and snow competently. In general, the MODIS algorithm appears to be robust for missing data (few cloud-free samples), but is sensitive to noise in data. Thus, subpixel clouds or geolocation errors can diminish accuracy. Impacts of sensor degradation with time (e.g., decreasing signal-to-noise) have yet to be determined.

Key Issues

Breakout groups, focused on site-level measurements and product developers' validation needs, met on both days. The site-level group developed a prioritized list of challenges, including scaling point measurements to values commensurate with product cell sizes, instrument calibration, aircraft-based data, "footprint" analysis and standards, and cloud-filtering.

The group emphasized the validation of broadband (vs. spectral) products due to the relative maturity and prevalence of the associated field instrumentation and satellite algorithms. Some science networks, e.g., the Baseline Surface Radiation Network (BSRN), have developed error budgets for point-scale broadband measurements. At present, however, the various data validation chains to scale up field data (from point to satellite-product cell size) are relatively complex and involve many stages. It is not clear which are the critical elements in terms of error sources (e.g., radiometric calibration of the ground-based instrumentation, atmospheric correction of the intermediate spatial resolution image data, application of plant-growth models (where appropriate), spatial aggregation, or narrow-to-broad-band conversion of satellite

data). Guidelines for field instrument height relative to surface-heterogeneity scale are also not established. Participants agreed that a rigorous, statistical error-budget analysis is required, and this could be achieved through a community effort including aircraft-based pyranometers.

Group members also noted that a wide range of field instrumentation is currently used to acquire field albedo data. The significance of differences between the values from these instruments, variations from manufacturer to manufacturer, or variations between similar instruments produced by the same manufacturer, are currently unknown. In part, this arises from varying practices relating to the absolute radiometric calibration of the instruments by the manufacturers and the users. To resolve some of these issues, participants suggested a coordinated field-measurement and calibration campaign or a "round robin" approach using a reference-calibration instrument passed between user sites. This effort could be supported by a national standards or instrument vendor calibration laboratory.

The product developer subgroup noted that product accuracy is estimated through a convergence of evidence, including that from site, aircraft, and other satellite product comparisons. Global validation priorities, particularly the number and spatial distribution of sites, remained unresolved, pending further analysis of the MODIS and other satellite products. Climate modelers in attendance advocated closer ties between their community and product validation scientists such that regional albedo outliers found through modeling studies could be

rapidly addressed and resolved via campaigns. This would complement long-term monitoring sites required for annual cycles.

Next Steps

The final session was dedicated to developing a research agenda and discussing albedo community coordination. The Oak Ridge National Laboratory (ORNL) DAAC accepted an action to create and distribute 7-km x 7-km ASCII-formatted subsets of the MODIS albedo product over more than 200 sites involved in various science networks (e.g., FLUXNET, BSRN, EOS Core Sites). The data will complement other MODIS product subsets currently available through the DAAC (see public.ornl.gov/fluxnet/modis.cfm). The action will be expedited such that subsets are generated for the complete MODIS Collection 4 reprocessing, slated to begin in November 2002. **Alan Strahler** proposed that participants meet again in about one year to discuss evolving priorities, including coordinated activities, as validation extent and quality mature.

Details of the workshop, including copies of presentations and breakout group recommendations, will be available through the LPV web site (modis.gsfc.nasa.gov/MODIS/LAND/VAL/CEOS_WGCV/surfrad.html). Boston University will host an LPV-sponsored land-cover-validation workshop in December 2002. The next meeting of the CEOS WGCV will be in Hobart, Australia on February 12-14, 2003.

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